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A major goal of conducting polymer research involves designing scalable and inexpensive light-weight energy storage technologies. Polyaniline is useful in these applications due to its simple protonic doping mechanism and large electroactive surface area, allowing a high conductivity, response time, and sensitivity. Furthermore, development of a flexible polyaniline dispersed solution would allow for drop casting of a conductive liquid, thus providing a highly customizable energy storage device that can be ready overnight. Polylactic acid (PLA), a flexible plastic that is widely available and inexpensive, could be used to develop polyaniline+PLA composite films, characterized by a polyaniline nanofiber percolation network, and could achieve the goal of both high flexibility and energy storage capacity.

To develop such a conductive material, polyaniline was first synthesized via a robust oxidation process involving interfacial polymerization. Formation of the nanofibers in the doped hydrophilic state immediately leave the interface site, allowing for continuous fiber development instead of secondary growth. The lyophilized powder product was incorporated into solutions along with a dispersant, a plasticizer, a fluorosurfactant, and PLA. Using these substituents, solution ratios and processing order were altered to develop superior drop-casted films. Quality of the resulting film was based on homogeneity, flexibility, conductivity, optical micrographs, and two-point probe analysis.

Optimization determined a composite solution for a conductive and partially flexible film. However, the high degree of homogeneity and flexibility for widespread energy storage application was not obtained with these substituents and process design, limiting the current direction of this research. Furthermore, incorporation of flexible components into the film sacrificed the desirable properties of the polyaniline, thus reducing energy storage capabilities. Continued development of a flexible and conductive polyaniline liquid requires further optimization, likely involving different substituents and a different method of film synthesis.